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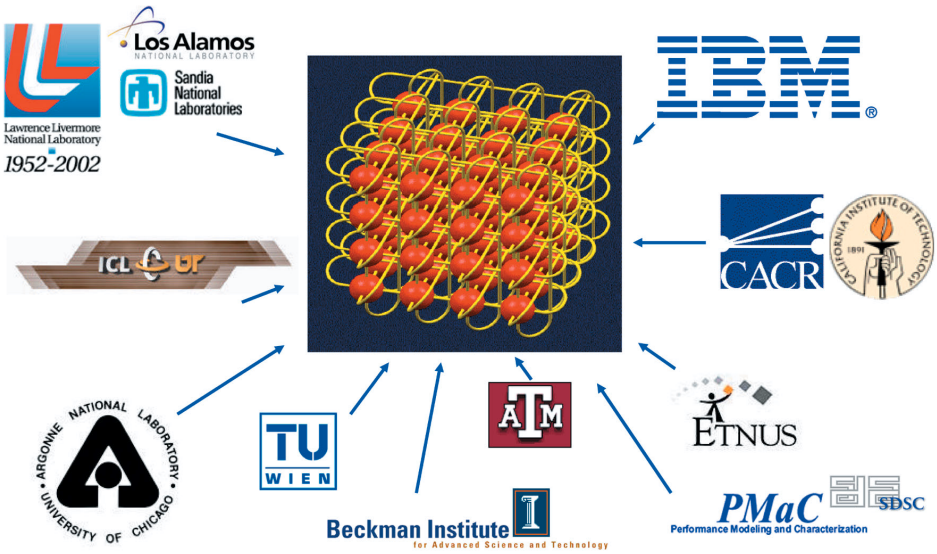
Facts on BlueGene/L

BlueGene/L (www.llnl.gov/asci/platforms/bluegenel/) is a computational sciences research and evaluation platform designed by IBM research for the DOE/NNSA Advanced Simulation and Computing Program (historically known as ASCI). Delivery is slated for Lawrence Livermore National Laboratory in December 2004. A smaller BlueGene/L prototype should be available prior to September 2003.



BlueGene/L is a collaboration involving the DOE/NNSA Advanced Simulation and Computing Program (ASCI) with a growing list of industrial and academic partners.

To achieve ultra-performance computing, BlueGene/L takes a radically different approach from supercomputers such as ASCI Purple. Utilizing a cell-based design methodology, BlueGene/L is a scalable architecture in which the computational power of the machine can be expanded by adding more building blocks, with no introduction of bottlenecks as the machine scales up. By utilizing system-on-a-chip (SOC) design technology and low-cost/low-power embedded microprocessors, BlueGene/L achieves a theoretical peak computational rate of 367 teraFLOP/s through extreme scalability[1]. With more than 2^{16} (65,536) dual processor nodes and 16 TB of memory (16×2^{40} bytes or 256 MB MB DDR SDRAM per node) this will be the fastest machine yet built. BlueGene/L has three main communications networks: a three-dimensional torus for nearest-neighbor calculations on grids; a global tree network for broadcasts and reduction operations; and a barrier network for synchronizing the complex algorithms in scientific calculations envisioned for the machine.

The ASCI strategy for utilizing this cutting edge research platform is to significantly enhance ASCI scientific simulations with BlueGene/L in targeted areas for maximum benefit. These areas include *ab initio* molecular dynamics for material science and computational biology, three-dimensional dislocation dynamics for materials modeling, molecular dynamics, kinetic Monte Carlo,

[1] A teraFLOP/s is one trillion (10^{12}) floating-point operation per second.

turbulence, shock and instability phenomena in hydrodynamics. The more complicated multi-physics mainline ASCI and stockpile stewardship applications are targeted at ASCI Purple. The much simpler science applications targeted at BlueGene/L will relieve some of the intense demand for access to ASCI Purple. With this unique resource, BlueGene/L will provide ASCI science researchers with a tool for computational science that is much more advanced than anything else available. It will be analogous to having access to the first electron microscope, while everyone else in the world still makes observations with optical microscopes.

The BlueGene/L compute main section will be housed in 64 cabinets, with an additional 32 cabinets anticipated for the I/O subsystem. BlueGene/L will occupy the new Terascale Simulation Facility currently under construction at Lawrence Livermore National Laboratory. The Laboratory plans to utilize BlueGene/L as the vehicle for deploying revolutionary file system technology for large-scale storage, providing ultra-high bandwidth sharing of data between multiple systems, and visualization platforms on the same system area network.

BlueGene/L* at a Glance

Number	Attribute
367 teraFLOP/s (in symmetric mode) 184 teraFLOP/s (in communications co-processor mode)	Peak computational rate
16 TB (16×2^{40} bytes)	Aggregate memory
400 TB (400×10^{12} bytes)	Aggregate global disk
40 GB/s (40×10^{9} bytes/second)	Delivered I/O bandwidth to applications
1,024 x 1-Gb/s Ethernet (in 10^{9} bits/second)	External networking
65,536 (131,072)	Number of nodes (processors)
256 MB (256×2^{20} bytes)	Memory per node
Dual PowerPC 440	Microprocessor technology
2 MW (2×10^{6} Watts)	Power required for computer and cooling
>4,500,000 BTU/hr	Heat generated
>5,000	Cables in the machine
>12 miles	Aggregate cable length

* target specifications

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